

**CLAIMS**

What is claimed is:

1. A method of testing a plant control system comprising:  
providing a control system to be tested, the control system having a controller-I/O communication channel and field I/O connectors;  
providing a test system;  
coupling the test system to the control system in a manner which allows the test system to communicate with and drive the control system by sending and receiving signals via both the controller-I/O communication channel and the field I/O connectors.
2. The method of claim 1 further comprising:  
decoupling the test system from the control system;  
at least partially installing the control system in a plant to be controlled;  
utilizing at least a portion of the test system to validate the operation of the control system.
3. The method of claim 2 wherein validation of the control system involves coupling an I/O portion of the test system in place of at least some of the plant's sensors and actuators.
4. The method of claim 2 wherein validation is accomplished by utilizing at least a portion of the test system to validate the operation of the control system by having the test system provide instructions and questions to one or more plant operators thereby instructing them to perform various operations and prompting them to enter a description as to how the control system responded to the operations, and recording any operator entered descriptions.
5. The method of claim 4 further comprising a step of causing the test system to generate a report indicating which operations were performed and what the control system response was for any operations performed.
6. A method for testing a plant control system having a controller, a sensor input port, an actuator output port, a series of communication segments communicatively coupling the sensor input port to the controller such that an input signal applied to

the sensor input results in one or more signals traveling along each of the communication segments so as to notify the controller of the applied input signal, and a series of communication segments communicatively coupling the controller to the actuator output port such that a control signal generated by the controller results in an output signal being applied to the actuator output port, the method comprising:

providing a simulator and coupling the simulator to the control system at at least three points, wherein a first point is the sensor input port, a second point is a point from which data relating to the internal state of the controller can be obtained, and a third point is the actuator output port;

causing the simulator to apply a signal to the first point and to subsequently obtain data on the internal state of the controller and to monitor the actuator output port for any applied signals.

7. The method of claim 6 with the control system further comprising an I/O interface wherein coupling the simulator to the control system at the second point involves tying the simulator into a network used as a communication segment between the controller and the I/O interface.
8. The method of claim 7 wherein the I/O interface comprises at least two analog/digital converters with a first, input converter converting an analog input signal applied to the sensor input by the simulator or sensor into a digital signal which is transmitted to the controller; and a second, output converter converting a digital signal received by the I/O interface from the controller into an analog signal which is transmitted to the simulator or actuator.
9. The method of claim 8 wherein the simulator obtains data on the internal state of the controller by establishing a network connection with the controller and requesting that the controller report its internal state.
10. A plant sensor and actuator simulator for use in testing a plant control system comprising:  
a configurator having a computer and software for entering and maintaining one or more databases including validation requirements and associated test

11. The simulator of claim 10 wherein the configurator databases comprise data on a plurality of plant sensors such that, for each control system sensor input, the configurator identifies the range of signals which can be produced by a sensor and identifies a series of signals to be used in testing the control system response to signals within and without entire range of signals.
12. A method for training process operators comprising:
- providing a plant comprising a HMI to a control system coupled to plant sensors and actuators and controlling a process;
- disconnecting all of the sensors and actuators from the control system;
- connecting a simulator to the control system in place of the sensors and actuators;
- causing the simulator to simulate various plant events so that the operators can interact with the HMI as if such events were actually occurring.
13. The method of claim 12 wherein the simulator comprises a database of events and preferred responses, monitors operator responses to simulated events by monitoring the control system's internal state and/or outputs, compares the monitored response for a particular event to the preferred response to determine whether the operator succeeded or failed to provide the preferred response, and reporting on the operator's successes and/or failures in responding to the simulated events.